A Method

For finding the Number *of the* Julian Period *for any Year aſſign'd, the* Number *of the* Cycle *of the* Sun, *the* Cycle *of the* Moon, *and of the* Indictions *for the ſame year, being given*; *together with the* Demonſtration *of that Method.*

IN theſe *Tranſactions*, *N°* 18. *p.* 324. is a *Theorem* for finding the Year of the *Julian Period* by a new and very eaſie Method, which was taken out of the *Journal des Scavans*, *N°* 36. as it had been propoſed and communicated by the Learned Jeſuit *De Bill.*

Multiply the $\left\{\begin{array}{l}\textit{Solar}\\ \textit{Lunar}\end{array}\right\}\textit{Cycle}$ $\left.\begin{array}{l}\\ \\ \textit{Indiction.}\end{array}\right\}$ by $\left\{\begin{array}{l}4845.\\ 4200.\\ 6916.\end{array}\right\}$ Then divide the ſum of the Products by 7980 (the *Julian Period*) the Remainder of the Diviſion, without having regard to the Quotient, ſhall be the Year inquired after.

Some Learned Mathematicians of *Paris*, to whom the ſaid *P. de Billy* did propoſe this Problem, have found the Demonſtration thereof as the ſame *Journal* intimates.

There being no further Elucidation of the ſaid *Theorem* ſince publiſh'd, Mr. *John Collins*, now a Member of the *Royal Society*, communicated what follows, *viz.*

That the *Julian Period* is a Baſis, whereon to found *Chronology* not liable to Controverſie, as the Age of the *World* is: And 'tis the Number aboveſaid, to wit, 7980, which is the Product of $\left\{\begin{array}{l}28\\ 19\\ 15\end{array}\right\}$ the $\left\{\begin{array}{l}\textit{Solar}\\ \textit{Lunar}\end{array}\right\}\textit{Cycle.}$ $\begin{array}{l}\\ \\ \textit{Indiction.}\end{array}$

Concerning this *Julian Period*, the late Archbiſhop of *Armagh*, *Uſher*, in the Preface to his Learned Annals, advertiſeth, that *Robert Lotharing*, Biſhop of *Hereford*, firſt obſerved the Conveniencies thereof; 500 years after whom, it was fitted for Chronological uſes by *Joſeph Scaliger*, and is now embraced by the Learned as ſuch a limit to *Chronology*, that within the ſpace of 7980 Years, the *Number* of the *Sun's Cycle*, the *Prime*, and the year of the *Roman Indiction* (which relates to their ancient Laws

and

and Records) can never happen alike. And these Remarques being given, the year of the *Julian Period* is by the former Rule infallibly found.

This *Period* is used by the said Archbishop in his *Annals*, and is by him accounted to exceed the Age of the *World* 709 years. Those that desire further satisfaction about *Æra's*, *Epocha's*, and *Periods*, may repair to many Authors, and among them to *Gregory's Posthuma* in English, *Helvici Chronologia*, *Ægidii Strauchii Breviarium Chronologicum*, who is one of the latest Authors.

Now as to the *Problem* it self, it may be thus proposed :

Any number of Divisors, together with their Remainders after Division, being proposed, to find the Dividend.

This thus generally proposed is no *new* Problem, and was resolved long since, by *John Geysius*, by the help of particular Multipliers, such as those above-mentioned, and publish'd by *Alstedius* in his *Encylopædia* in *Ann.* 1630. and by *Van Schooten* in his *Miscellanies*.

We shall clear up, what Authors have omitted concerning the *Definition* and *Demonstration* of such fixed Multipliers, *&c.* And therefore say, that each Multiplier is relative to the Divisor, to which it belongs, and thus define it ;

It is such a Number, as divided by the rest of the Divisors, or their Product, the Remainder is 0 ; *but divided by its own Divisor, the Remainder is an* Unit.

We require the Divisors proposed to be *Primitive* each to other, *i. e.* that no two or more of them can be reduced to lesser terms by any common Divisor: For if so, the Question may be *possible* in it self, but not resolvable by help of such Multipliers, such being impossible to be found. The reason is, because the Product of an Odd and Even Number is always Even, and that divided by an Even Number, leaves either Nothing, or an Even Number.

$$\text{Divisors}\left.\begin{array}{r}28\\19\\15\end{array}\right\}\text{ The Multipliers relative thereto are }\left\{\begin{array}{l}4845\\4200\\6916\end{array}\right.$$

The *Definition* affords light enough for the discovery of these Numbers. To instance in the *first*: The Product of 19 and 15 is

is 285, which multiply by all numbers ſucceſſively, and divide by 28, till you find the Remainder required. Thus twice 285 is 570, which divided by 28, the remainder is 10; alſo thrice 285 is 855, which divided by 28, the remainder is 15. Thus if you try on ſucceſſively, you'l find, that 17 times 285, which is 4845, is the Number required, the which divided by 28, the Remainder is an *Unit*. Hence then we ſhall find, that

4845	is equal to the Solid or Product of	19, 15, 17.
4200		28, 15, 10.
6916		28, 19, 13.

More eaſie ways of performing this *poſtulatum*, are to be found in *Van Schooten*'s *Miſcellanies*, and *Tacquet*'s *Arithmetick*, which perchance are not ſo obvious to every underſtanding.

For illuſtration of the *Rule* propoſed, take this Example.

			The Multipliers.	Products.
In the year 1668.	*Cyclus Solis*	25	4845	121125
	Cyclus Lunæ	16	4200	67200
	Indictio	6	6916	41496
			The Sum of the Products	229821

The which divided by 7980, the remainder is 6381, for the year of the *Julian Period*; from which ſubtracting 709, there remains 5672, for the Age of the World, according to Archbiſhop *Uſher*.

For DEMONSTRATION of this *Rule* we thus argue:

1. *Each Multiplier multiplied by its Remainder, is meaſured or divided by its own Diviſor, leaving ſuch a Remainder as is propoſed.*

For before, each Multiplier was defined to be a *Multiplex* of its own Diviſor, *plus* an *Unit:* Wherefore multiplying it by any Remainder, it doth only render it a greater *Multiplex* in the ſaid Diviſor, *plus* an *Unit*, multiplied by the Remainder, which is no other than the Remainder it ſelf; but if 0 remain, that Product is deſtroyed.

2. *The Sum of the Products, divided by each reſpective Diviſor, have the Remainder aſſigned.*

For concerning the firſt Product, it is by the firſt *Section* meaſur'd

ſur'd by its own Diviſor, leaving the remainder propoſed ; and if we add the reſt of the Products thereto, we only add a *Multiplex* of its own Diviſor, which in Diviſion enlargeth the *Quote*, but not the *Remainder*.

Particularly the ſecond Multiplier is 28 + 15 + 10 + Remainder, all which is but a *Multiplex* of 28.

And ſo the third Product is 28 + 19 + 13 + Remainder.

And what hath been ſaid concerning the ſum of the Products, being divided by the firſt Diviſor, and leaving the Remainder thereto aſſign'd, may be ſaid of each reſpectively.

3 *The ſum of the Products divided by the ſolid of the three Diviſors, leaves a Remainder ſo qualified as the ſaid Sum.*

For concerning the ſaid Sum, 'tis evident by the *ſecond* hereof, that it is no other than the firſt Product; increas'd by *adding* a juſt *Multiplex* of the firſt Diviſor, that thereby we did only *enlarge* the *Quote*, not *alter* the *Remainder*. By the like reaſon, the *ſubtracting* a juſt *Multiplex* thereof, doth only *alter* the *Quote*, not the *Remainder* ; but the Solid of all three Diviſors, multiplied *here* by the *Quote*, as *there* by the *Remainder*, is no other than a juſt *Multiplex* of the firſt Diviſor. Wherefore the Remainder, after this Diviſion is perform'd, is of the ſame Quality as the ſum of the Products, and divided by the firſt Diviſor, leaves the Remainder proper thereto. And the like may be ſaid concerning each Diviſor.

AS in the Method hitherto deliver'd, we requir'd the Diviſors be *Primitive* to each other ; ſo, if we take the *Problem* as generally propoſed, in the Preface to *Helvicus* his *Chronologia*, we are told, common Arithmetick fails in the ſolution thereof, and *Tacquet* denies it to be performable by the *Regula Falſi*, and being unlimited, we muſt do it by Tryals. Wherefore,

When any two Diviſors with their Remainders are propoſed, try the Multiplices of one of them, increaſed by its Remainder, and divide by the other : If you find ſuch Remainders as are not for the purpoſe, and that they are repeated, the Problem is impoſſible.

		6.		3.
Example.	Diviſors		Remainders	
		8.		5.

The Multiplices of 8, increased by 5, are . .	13. 21. 29. 37. 45. 53.
Those divided by 6, the Remainders are . .	1. 3. 5. 1. 3. 5.

Here you see 21 and 45 for the purpose, and take the Progression, adding the common Difference 24 (which is the least Dividend measured by 6 and 8) and you have 21. 45. 69. 93. 117. 141.

Admit, the Question had concerned these three Divisors:

Divisors		Remainders
6	the Remainders being	3
8		5
9		6

Then dividing the former Progression by 9, the Remainders are 3. 0. 6. 3. 0 6. Wherefore I conclude, that the third and sixth of these Numbers are those sought, to wit, 69 or 141, and so on progressively; whereas, if you had propounded the Remainder of 9 to have been any other Number than 3, 0, 6, the *Problem*, as concerning all these, had not been possible.

Some easie Cases of the Problem are these:

When the Remainder of some Divisor is 0, and of each of the rest of the Divisors, an *Unit*, or less by an *Unit*, than the Divisor.

In which Cases you are to find such a *Multiplex* of the Product or least Dividend measurable by those Divisors that have Remainders, which increas'd or diminish'd by an *Unit*, may be a just *Multiplex* of that Divisor that hath no Remainder. These Cases are handled by *Tacquet*, and *Bachet* in his *Problemes plaisans & delectables*.

PROBLEM.

To find the Year of the Julian Period for any year of our Lord proposed.

It is necessary to be furnished with the *Sun's Cycle*, the *Prime Number*, and the Number of the *Roman Indiction*, which the industrious Mr. *Street* thus performs:

When

When 1. 9. 3. *to the Year hath added been,*
Divide by 19. 28, *fifteen.*

The Remainders are the Numbers sought. And hereby we found them for the year 1668. in the former Example

The use of the *Prime* is, to find the *Epact*, and thereby the *Moons Age*, time of *High Water*, &c.

A farther use of the *Suns Cycle* is, to attain the *Dominical Letter*, and thereby to know the *Day* of the *Week*, on which any Day of the Month happens. But this is more easily and with less caution obtain'd, by finding on what Day of the Week the first of *March* happens for ever, according to such *Rules* and *Verses* as I have elsewhere published. In brief thus:

To the Number . . . . 2.
Add the Year of our Lord, suppose 1669.
And its even 4*th* part, neglecting what remains, if any . . } 417.

The Sum . . . . . . 2088. Divide by 7, noting the Remainder, which shews the Number of the Day of the Week, accounting *Sunday* first. If 0 remain, the *first* of *March* falls on a *Saturday.* In this Example there remains 2, shewing the *first* of *March* to fall on *Monday.*

If it were required to perform this for years *preceding* our *Saviour's Nativity*, then take this *Rule:*

To the Year add its even fourth part, the Sum divide by 7, the Remainder shews the Day of the Week, accounting *Sunday* first, *Saturday* second, and so backward.

PROBLEM.

To find what day of the Month in the first Week of each Month, happens to be on the same day of the Week as the first of March.

Use the (plain) following *Verses*, in which the twelve Words relate to the twelve Months of the Year; accounting *March* the first:

Ask endless Comfort, God enough bestows,
From Divine Axioms Faith confirmed grows.

The Alphabetical Number of the first Letter of the word, proper to the Month proposed, is the Answer.

Example.

If the Month were *April*, the word proper thereto is *Endless*, and *E* is the fifth Letter in the Alphabet. Wherefore conclude, That the first of *March* and *fifth* of *April* do for ever happen on the same day of the Week; which for the year 1669. will be on *Monday*.

PROBLEM.

To find on what day of the Week the first day of each Month happeneth.

Supposing the first of *March* known, it might be reckoned from the former *Problem*, but the following *Verse*, beginning with *March*, as the former, is more ready for the purpose:

> *A dreadful Fire, Beholders daily Gaze,*
> *Chastized* England. *Ah cruel fatal Blaze.*

Explication.

In the Year 1669, the *first* of *March* is *Monday*; I would know on what *day* of the *week* the *first* of *October* happens. The word proper to the Month is *England*; then count Alphabetically to *E*, *viz.* *A.* Monday, *B.* Tuesday, *C.* Wednesday, *D.* Thursday, *E.* Friday, which is the day sought. Whence conclude, that the *1st*, *8th*, *15th*, *22th*, *29th* days of *October* are all *Fridays*. Thence it is easie to reckon, on what day of the Week any day of that Month happened; and so for all other Months.

PROBLEM.

To find on what Day of the Month the Sun enters into any Sign of the Zodiack.

For this, *ex super abundanti*, we give the following Verse:

> Charles *brought Content, divers Effects ensue,*
> *Envy, Fear, Dolour, Danger, bids adieu.*

Here again the twelve Words relate to the twelve Months, *March* being the first.

To

To the number of the Letter of the *Alphabet* the word begins with, add 7.

Example. *Bear* is the word for *October*, and *F* the sixth Letter: Wherefore the Sun enters into the 8*th* Sign, to wit, *Scorpio*, on the 13*th* of *October*.

An Account of some Books.

I. PETRI LAMBECII LIB. PRIMUS PRODROMI *HISTORIÆ LITERARIÆ*, &c. ——

THe Author of this Book is now the *Historiographer* and *Library-keeper* to the Emperour. He publish'd this Volume some few years ago at *Hamburgh*, the place of his Birth, (whence an Exemplar was but lately sent to the *Publisher*.) He was excited to this Work by the complaint made by the illustrious Lord *Verulam*, (*Lib. 2. cap. 4. de Augm. Scientiarum*) of the want of a compleat *History* of *Learning*, that might give a *satisfactory* Account of the Rise, Progress, Transmigrations, Interruptions, Declinations, and Restaurations of all kind of Learning, Sciences, Arts, and Inventions; together with the *occasion* of Inventions through *all* Arts; the *method* of teaching, and the *manner* of improving and advancing them: Adding the various *Sects*, and the most famous *Controversies* among the Learned; the *Encouragements* they received; the chief *Writings* they composed; their *Schools*, *Academies*, *Societies*, *Colledges*, *Successions*, *Orders*, and whatever belongs to the *state* of Learning.

This grand *Desideratum* our Author undertakes to supply the World with, and in order thereunto, hath given us the *first Book* of the *Prodromus* of this History, and with it the *four first Chapters* of the *Second Book*, together with an *Appendix*, containing a *Summary* of the chief *Persons* and *Things* he intends more fully and accurately to treat of in the remaining 32 Chapters, designed for the same *second Book*: To which, he subjoins two Tables of *Universal Chronography*, in the first whereof he exhibits the succession of all Ages from the Creation of the World to the beginning of the common *Christian* Account; in the *other*, a Continuation of them from the beginning of the said Account unto this present Age: In which *Tables* he gives a general *Idea* of the Connexion of all Ages, as they are computed in respect of the